



UNIVERSITI PUTRA MALAYSIA

**VEGETATION ASSOCIATION AND SITE PREFERENCES OF
TONGKAT ALI (EURYCOMA LONGIFOLIA JACK) IN A HEALTH
LOWLAND FOREST, PAHANG, MALAYSIA**

ZAHARI IBRAHIM.

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By

ZAHARI IBRAHIM

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Tongkat Ali (*Eurycoma longifolia* Jack) is one of the most popular medicinal plants and is gaining greater recognition in Malaysia. Currently, *E. longifolia* is being over-exploited due to its high popularity as a potential herbal medicine and high demand in the market. Thus, this study on the species site preferences of *E. longifolia* is necessary to ensure successful conservation of the species. There have been no studies reported on the ecological requirements, vegetative association, microclimate and site-suitability of *E. longifolia*. The objectives of this study are to identify the vegetative association and tree species composition of *E. longifolia* in its natural habitat; to determine the relationship between these

plant associations and the soil characteristics and to determine the relationship between foliar nutrient concentrations and density of *E. longifolia*.

The study was carried-out in a heath lowland forest, located in Compartments 6 and 10 of Menchali Forest Reserve, Rompin, Pahang. A total of 20 vegetation samples (relevé), each with the size of 30 m x 30m (900m²) were established in Compartment 6 (secondary forest) and Compt. 10 (primary forest) and were classified into four groups based on coverage density of *E. longifolia* viz, rare (E1), low (E2), moderate (E3) and high (E4). This study is basically a phytosociological study using the design primarily based on the Braun Blanquett Method (1964). A quantitative study of the vegetation layer namely dominant (T1), understorey (T2), shrub (S) and Herbs (H)) were recorded from 900m² relevés to include species composition , association , diversity and plant communities of this area. The environmental variables viz soil temperature, moisture content, pH, bulk density, particle density, soil nutrients, organic matter, soil micronutrients, light intensity and altitude were also analyzed and recorded for each relevés. In addition, foliar analysis of *E. longifolia* and shrub species was also done.

The results revealed that there are 207 species of trees, shrubs, herbs, ferns and herbaceous plants representing 74 families and 155 genera. It also found that there are seven types of life forms in Menchali Forest Reserve, namely woody plant, ferns, moses, climbers, palms, herbaceous and epiphytes, whereas the woody plants are the most abundant constituting of 53.2% by family 62% by genera and 61% by species. *Eurycoma longifolia*, *Brackenridgea palustris*, *Garcinia nigrolineata*, *Syzygium syzygioides*, *Diospyros styraciformis*, *Ardisia crenata*, *Dipterocarpus chartaceus*, *Calophyllum canum*, *Psydrax maingayi*, *Memecylon edule*, *Shorea materialis*, *Vatica pauciflora*, *Champereia manillana*, *Erythroxylum cuneatum*, *Guioa pleuropteris*, *Tetracera indica*, *Syzygium campanulatum* and *Licuala spinosa* were among the common species in the study area. These were differentiated into two differential communities of *Vitex pinnata*-*Bouea macrophylla* and *Xanthophyllum wrayi*-*Bromhaedia finlaysoniana*. The two communities constituted sixteen sub-communities which represent the association species of *E. longifolia*.

The results of soil analysis showed that most of the soil physical and chemical properties were significantly different ($p < 0.05$) among the cluster groups such as total nitrogen (N), total phosphorus (P), calcium (Ca), sodium (Na), magnesium (Mg), copper (Cu), zinc (Zn) and soil pH. The correlation analysis between the soil parameters and density of *E. longifolia* showed that the soil

parameters influenced the distribution of this species are moisture content, soil pH, Total P, Ca, Cu, Zn, Mn and Fe. Foliar nutrient concentrations are not significantly different among the cluster groups except for Mn and Zn. Light intensity in Group E1 recorded the highest value in light intensity (4012 lux) while the lowest value was in Group E4 (1651.71 lux). The light intensity was significantly different ($P \leq 0.05$) among the cluster groups. This indicates that the distribution of *E. longifolia* was mainly as understorey growth and is considered as a shade-tolerant species.

Relationship between species and environmental variables showed that light intensity, soil moisture content, pH, texture (%), total P, calcium, copper and zinc were among the important factors in the distribution of the vegetation in Menchali forest. This implies that the site preferences and density of *E. longifolia* was also influenced by these factors. The results of this study also showed the usefulness of phytosociological study in the development of community association of similar species growing in heath lowland forest. It is useful to develop association community of *E. longifolia* in the heath lowland forest, and to provide valuable information for rehabilitation, conservation and restoration of *E. longifolia*.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains.

**PERSEKUTUAN TUMBUHAN DAN CIRI-CIRI KAWASAN BAGI
TONGKAT ALI (*EURYCOMA LONGIFOLIA* JACK) DI HUTAN PAMAH
KERANGAS, PAHANG, MALAYSIA**

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Tongkat Ali (*Eurycoma longifolia* Jack) adalah diantara spesies tumbuhan ubatan yang paling popular dan semakin mendapat pengiktirafan di Malaysia. Pada masa kini, *E. longifolia* telah dieksploit tanpa kawalan kesan daripada populariti yang tinggi sebagai tumbuhan herba yang berpotensi dan permintaan yang tinggi di pasaran. Untuk itu, kajian tentang spesies dan ciri-ciri kawasan bagi *E. longifolia* adalah sangat diperlukan dalam memastikan kejayaan pemeliharaan spesies ini. Tiada lagi yang kajian dilaporkan keatas spesies ini berkaitan dengan keperluan ekologi, persekutuan tumbuhan (komuniti tumbuhan), mikroklimaks dan kesesuaian spesies dengan kawasan bagi *E. longifolia*. Bagi maksud tersebut, kajian ini dijalankan bertujuan untuk mengenal pasti

persekutuan komuniti tumbuhan dan komposisi spesies bagi *E. longifolia* di dalam habitatnya sendiri, menentukan kaitan persekutuan tumbuhannya dengan ciri-ciri tanah dan menentukan perkaitan diantara kandungan nutrient daun *E. longifolia* dengan kepadatan taburannya.

Kajian ini telah dijalankan di hutan tanah pamah jenis 'heath' di Kompatmen 6 dan 10, Hutan Simpan Menchali, Rompin, Pahang. Sejumlah 20 relevé (kuadrat tumbuhan) , dimana setiap satunya bersaiz 30 m x 30 m (900m²) telah ditubuhkan di Kompatmen 6 dan 10 dan seterusnya telah dikelaskan kepada empat kumpulan berasaskan kepada kepadatan litupan *E. longifolia* iaitu liar/tiada (E1), rendah (E2), sederhana (E3) dan tinggi (E4). Rekabentuk kajian yang digunakan adalah kaedah 'fitososiologi', berdasarkan kepada Braun-Blanquet (1951). Kajian secara kuantitatif keatas lima strata tumbuhan iaitu Dominan (T1), Sub-Dominan (T2), Jaras (S), Anak Pokok (H) dan Lumut (M) telah dibanci dan direkodkan maklumat-maklumat berkaitan dengan komposisi spesies, persekutuan dan kepelbagaian hayat. Pembolehubah alam persekitaran juga direkodkan seperti fizikal dan kimia tanah, keamatan cahaya dan ketinggian (altitude). Sebagai tambahan, analisis daun bagi kategori pokok dan renik *E. longifolia* juga dijalankan.

Keputusan menunjukkan terdapat 207 spesis berkayu, poko renek, paku-pakis, pepanjat, lumut, tumbuhan herba dan epifit yang merangkumi 74 famili dan 155 genera. Kajian juga mendapati bahawa terdapat tujuh jenis bentuk tumbuhan hidupan di kawasan Hutan Simpan Menchali iaitu tumbuhan berkayu adalah yang terbanyak dengan famili 53.2%, genera 62% dan spesis 61%. *Eurycoma longifolia*, *Brackenridgea palustris*, *Garcinia nigrolineata*, *Syzygium syzygioides*, *Diospyros styraciformis*, *Ardisia crenata*, *Dipterocarpus chartaceus*, *Calophyllum canum*, *Psydrax maingayi*, *Memecylon edule*, *Shorea materialis*, *Vatica pauciflora*, *Champereia manillana*, *Erythroxylum cuneatum*, *Guioa pleuropteris*, *Tetracera indica*, *Syzygium campanulatum* and *Licuala spinosa* adalah diantara spesies yang biasa ditemui di kawasan kajian. Ianya kemudian dapat di bezakan kepada dua komuniti tumbuhan iaitu komuniti *Vitex pinnata*-*Bouea macrophylla* (Leban-Kundang) dan komuniti *Xanthophyllum wrayi*-*Bromhaedia finlaysoniana* (Minyak Berok-Orkid). Kedua-dua komuniti ini mempunyai enam belas sub-komuniti dimana ianya mewakili spesies yang bersekutu dengan *Eurycoma longifolia*.

Keputusan daripada analisa tanah menunjukkan kebanyakan elemen fizikal dan kimia tanah terdapat perbezaan yang ketara pada ($P < 0.05$) diantara kumpulan-kumpulan relevé. Taburan tumbuh-tumbuhan dan juga *E. longifolia* adalah dihadkan oleh elemen tanah seperti nitrogen (N), jumlah fosforus (P), kalsium

(Ca), natrium (Na), magnesium (Mg), kuprum (Cu), zink (Zn) dan pH tanah. Beberapa ciri-ciri fizikal seperti kandungan kelembapan, tekstur dan ketumpatan pukal juga mempengaruhi tumbesaran dan taburan *E. longifolia*. Kesemua elemen nutrient daun didapati tidak menunjukkan perbezaan yang ketara diantara kumpulan kecuali dua elemen iaitu mangan (Mn) dan zink (Zn). Sementara itu, keputusan keamatan cahaya kumpulan E1 mencatatkan nilai keamatan yang tinggi (4012 lux) manakala nilai yang rendah adalah bagi (1651.71 lux). Nilai-nilai keamatan cahaya adalah berbeza di antara kumpulan dan terdapat perbezaan yang ketara di kalangan kumpulan, ini menunjukk *E. longifolia* adalah dari jenis spesies toleran kepada naungan.

Perkaitan di antara spesies dan alam persekitaran pula menunjukkan keamatan cahaya, kandungan kelembapan tanah, pH, tekstur tanah, jumlah P, Ca, Cu dan Zn adalah diantara faktor-faktor utama dalam taburan tumbuhan di Hutan Simpan Menchali Ini bermakna rujukan kawasan dan kepadatan *E. longifolia* juga dipengaruhi faktor-faktor tersebut. Keputusan daripada kajian ini juga menunjukan kepentingan kajian ini dalam pembangunan persekutuan tumbuhan bagi *E. longifolia* di hutan jenis ini dan memperolehi maklumat-maklumat yang berguna untuk pemuliharaan, konservasi dan penanaman *E. longifolia*.

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I certify that an Examination Committee met on December, 13 2005 to conduct the final examination of Zahari bin Ibrahim on his Master of Science thesis entitled "Vegetation Association and Site Preferences of *Eurycoma longifolia* Jack in a Heath Lowland Forest of Menchali Forest Reserve, Pahang State of Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledge. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



ZAHARI IBRAHIM

Date: 14 Feb 2006

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